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DEPARTMENT OF COMMERCE
National Institute of Standards and Technology

[Docket No. 950317077-5077-01]
RIN No. 0693-AB13

PROPOSED REVISION OF
FEDERAL INFORMATION PROCESSING STANDARD (FIPS)
177, INITIAL GRAPHICS EXCHANGE SPECIFICATION (IGES)

AGENCY: National Institute of Standards and Technology (NIST),
Commerce.

ACTION: Notice; Request for comments.

SUMMARY: NIST is proposing a revision of FIPS PUB 177, Initial Graphics Exchange Specification (IGES). IGES defines a neutral file format for the exchange of product model data and representation among differing computer-aided design and computer-aided manufacturing (CAD/CAM) systems. This proposed revision will provide increased clarification and enhancement of the existing standard, and added conformance requirements and application protocols (APs) specified within the American National Standard Digital Representation for Communication of Product Definition Data, ANSI/US PRO/IPO (United States Product Data Association/IGES PDES Organization)-100-1993, Version 5.2.

Prior to the submission of this proposed revision to FIPS 177 to

the Secretary of Commerce for review and approval, it is essential to assure that consideration is given to the needs and views of manufacturers, the public, and State and local governments. The purpose of this notice is to solicit such views.

This proposed revision contains two sections: (1) An announcement section, which provides information concerning the applicability, implementation, and maintenance of the standard; and (2) a specifications section. Only the announcement section of the standard is provided in this notice. Interested parties may obtain copies of the ANSI/US PRO/IPO-100-1993 and the specified application protocols (Layered Electrical Product (LEP) Application Protocol; 3-D Piping Application Protocol; and Engineering Drawing (Class II) Subset (MIL-D-28000A)) from the National Computer Graphics Association, 2722 Merrilee Drive, Suite 200, Fairfax, VA, 22031, telephone: (703) 698-9600.

DATE: Comments on this proposed revision must be received on or before July 11, 1995.

ADDRESS: Written comments concerning the adoption of this proposed revision should be sent to: Director, Computer Systems Laboratory, ATTN: Proposed Revision of FIPS 177, IGES, Technology Building, Room B154, National Institute of Standards and Technology,

Gaithersburg, MD 20899.

Written comments received in response to this notice will be made part of the public record and will be made available for inspection and copying in the Central Reference and Records Inspection Facility, Room 6020, Herbert C. Hoover Building, 14th Street between Pennsylvania and Constitution Avenues, NW, Washington, DC 20230.

FOR FURTHER INFORMATION CONTACT: Ms. Lynne Rosenthal, National Institute of Standards and Technology, Gaithersburg, MD 20899, telephone (301) 975-3353.

EXECUTIVE ORDER 12866: This FIPS notice has been determined to be "not significant" for purposes of E.O. 12866.

Dated April 4, 1995

Samuel Kramer, Associate Director

**Proposed
Federal Information
Processing Standards Publication 177-1**

(Date)

Announcing the Standard for

INITIAL GRAPHICS EXCHANGE SPECIFICATION (IGES)

Federal Information Processing Standards Publications (FIPS PUBS) are issued by the National Institute of Standards and Technology (NIST) after approval by the Secretary of Commerce pursuant to Section 111(d) of the Federal Property and Administrative Services Act of 1949 as amended by the Computer Security Act of 1987, Public Law 100-235.

1. Name of Standard. Initial Graphics Exchange Specification (IGES) (FIPS PUB 177-1).

2. Category of Standard. Software Standard; Graphics and Information Interchange.

3. Explanation. This publication is a revision of the FIPS PUB 177 and supersedes FIPS PUB 177 in its entirety. It provides a substantial, upward-compatible enhancement of IGES Version 4.0. FIPS PUB 177-1 specifies new conformance requirements, the addition and use of application protocols (APs), and increased enhancement, correction, and clarification of the existing specification. It does not contain any new requirements that would make an existing conforming implementation nonconforming.

FIPS PUB 177-1 adopts the American National Standard Digital Representation for Communication of Product Definition Data, ANSI/US PRO/IPO (United States Product Data Association/IGES PDES Organization)-100-1993, Version 5.2, and the specified application protocols. FIPS PUB 177-1 addresses IGES implementation and data file acquisition, interpretation, and conformance.

The purpose of the FIPS for IGES is to enable the compatible exchange of product definition data used by dissimilar computer-aided design and computer-aided manufacturing (CAD/CAM) systems. Utilizing a neutral database format the IGES processor can create or translate two-dimensional (2-D) or three-dimensional (3-D) vector-based digital product model data. The standard specifies file structure and syntactical definition, and defines the representation of geometric, topological, and nongeometric product

definition data. The exact specification is in Section 10 of this standard.

4. Approving Authority. Secretary of Commerce.

5. Maintenance Agency. U.S. Department of Commerce, National Institute of Standards and Technology (NIST), Computer Systems Laboratory (CSL).

6. Cross Index.

a. American National Standard Digital Representation for Communication of Product Definition Data, ANSI/US PRO/IPO-100-1993, Version 5.2.

b. American Society of Mechanical Engineers/American National Standards Institute (ASME/ANSI) Y14.26M-1989, Digital Representation for Communication of Product Definition Data, IGES Version 4.0.

c. MIL-D-28000A, Continuous Acquisition and Life-Cycle Support Specification, Digital Representation for Communication of Product Definition Data: IGES Application Subsets and IGES Application Protocols, February 10, 1992.

d. American National Standard, 3-D Piping IGES Application Protocol, ANSI/US PRO/IPO-110-1994.

e. IGES Layered Electrical Product Application Protocol, Committee Draft SAND94-2375, December 1, 1994.

7. Related Documents.

a. Federal Information Resources Management Regulations (FIRMR) subpart 201.20.303, Standards, and subpart 201.39.1002, Federal Standards.

b. Federal ADP and Telecommunications Standards Index, U.S. General Services Administration, Information Technology Management Service, October 1994 (updated periodically).

c. FIPS PUB 29-3, Interpretation Procedures for Federal Information Processing Standards for Software.

d. NISTIR 4379, IGES Technical Illustrations Application Guide.

e. NISTIR 4600, IGES 5.0 Recommended Practices Guide.

f. NISTIR 5541, Initial Graphics Exchange Specification (IGES): Procedures for the NIST IGES Validation Test Service.

g. MIL-T-31000, General Specification for Technical Data Packages.

8. Objectives. Federal standards for electronic interchange permit Federal departments and agencies to exercise more effective control over the production, management, and use of the government's information resources. The primary objectives specific to IGES are to:

- Reduce the overall life-cycle cost for digital systems by establishing a common exchange format that allows for the transfer of product definition data across organizational boundaries and independent of any particular CAD/CAM system.
- Exchange digital representations of product definition data in various forms: illustrations, 2-D drawings, 3-D edge-vertex models, surface models, solid models, and complete product models.
- Provide CAD/CAM implementation manufacturers with a guideline for identifying useful combinations of product definition data capabilities in any CAD/CAM system.
- Specify Application Protocols that can be used by Federal departments and agencies to support the exchange of product data when applicable.

9. Applicability.

9.1 This FIPS for IGES is intended for the computer-interpretable representation and exchange of CAD/CAM product definition data among applications and programs that are either developed or acquired for government use. Each CAD/CAM system acquired or developed by a Federal agency shall include an IGES preprocessor and IGES postprocessor capability. FIPS for IGES is designed to support the exchange of 2-D or 3-D product definition data with rich attribute information. It provides a data format for describing product design and manufacturing information that has been created and stored in a computer-readable, device independent form.

9.2 The FIPS for IGES shall be used when one or more of the following situations exist:

- The product definition application or program is under constant review, and changes may result frequently.
- It is anticipated that the life of the data files will be longer than the life of the presently utilized CAD/CAM system.
- The application is being designed centrally for a decentralized system that may employ computers of different makes and models and different CAD/CAM devices.
- The product definition application may run on equipment other than that on which it was developed.
- The product definition data is to be used and maintained by other than the original designer.
- The product definition data is or is likely to be used by organizations outside the Federal Government.
- It is desired to have the design understood by multiple people, groups, or organizations.

9.3 For layered electrical product technology, three dimensional piping, and engineering drawing applications, the use of the appropriate application protocol or subset (as described below) is required for implementation of this FIPS IGES.

An AP or subset provides a means to improve the fidelity of the product data exchanged. APs are developed by domain experts for the purpose of defining the processes, information flows, and functional requirements of an application. An AP defines the scope, context, information requirements, representation of the application information, and conformance requirements. Initial release of this FIPS for IGES publication includes two application protocols and one application subset.

- Layered Electrical Product (LEP) Application Protocol: The LEP AP is used for the transference of 2-D electrical and electro-mechanical product models. This AP is required for layered electrical products technology applications, including specification control drawings, circuitry, fabrication and final assembly of a layered product system.
- 3-D Piping Application Protocol: The 3-D Piping AP is used for the exchange of models from one piping modeling application to another. This AP is required for 3-D piping and related equipment models, including the

fabrication and assembly of piping systems (e.g. pipe, pipe fittings, attached equipment, piping supports, and insulation).

- Engineering Drawing (Class II) Subset (MIL-D-28000A): The Class II subset is used for the exchange of the drawing model; including geometric and annotation entities, attributes such as color and line fonts, and organization information such as levels and subfigures. This subset is required for the exchange of engineering drawings and product data following MIL-T-31000 (General Specification for Technical Data Packages).

10. Specifications. This FIPS adopts ANSI/US PRO/IPO-100-1993 and the specified application protocols: Layered Electrical Product (LEP) Application Protocol; 3-D Piping Application Protocol; and Engineering Drawing (Class II) Subset (MIL-D-28000A). The ANSI/US PRO/IPO-100-1993 standard for IGES, defines the communications file structure and format (i.e., a file of entities), language format, and the representation of product definition data.

New entities and constructs are added with each revision and are upwardly compatible. Thus, a processor conforming to IGES Version 5.2 would be able to read and process an IGES Version 4.0 file, but the converse may not be true. The capabilities brought to the IGES user implementing the IGES Version 5.2 standard are:

- a new character set for the European Community;
- additional properties to the attribute table for Architecture/Engineering/Construction (AEC);
- the addition of a new form of the drawing entity; and
- the addition of a new class of entity use, termed construction information.

Conformance Requirements. Conformance is mandatory for this standard and is applicable to all Federal department and agency procurements. Conforming data files and processors must adhere to all the rules appropriate to specific features, such as entities, defined within ANSI/US PRO/IPO-100-1993 and any of the specified application protocols. Vendors of processors claiming conformance to this standard shall complete documentation which accurately indicates the processor's support of, and mapping between, native and IGES entities.

A conforming preprocessor shall create conforming IGES data files

which represent the native database which was input to the preprocessor. File content shall represent the native entities according to the vendor's completed documentation. It is desirable and recommended that the preprocessor report on any native feature or entity which has not been written to the IGES data file.

A conforming postprocessor shall translate conforming IGES data files into the native database form of a specific CAD/CAM system. It shall convert each supported entity into native constructs, which preserve the functionality and match the geometry, attributes, and relationships of the IGES entity in the file. It is desirable and recommended that the postprocessor report on any IGES entities or features which have been discarded.

Any visual presentation produced by the processor shall accurately and correctly represent the IGES constructs contained in the data file and specified by ANSI/US PRO/IPO-100-1993 and, if applicable, the AP or subset. For example, the display of a design which is filled with a pattern of lines as indicated by the pattern code of the Sectioned Area Entity (type 230) shall resemble the predefined definitions illustrated in the ANSI/US PRO/IPO-100-1993 specification.

Conformance Rules for Application Protocols and Subsets. An application protocol or subset which claims conformance to this standard, must satisfy the following rule:

- An implementation conforming to an AP shall satisfy the conformance requirements specified in the AP as well as the conformance requirements in the ANSI/US PRO/IPO-100-1993 specification.

11. Implementation. The implementation of this standard involves four areas of consideration: effective date, acquisition, interpretation, and validation.

11.1 Effective Date. This publication is effective six (6) months after date of publication upon final announcement in the *Federal Register*. A transition period of twelve (12) months, beginning on the effective date, allows industry to produce IGES implementations and data files conforming to this standard. Agencies are encouraged to use this standard for solicitation proposals during the transition period. This standard is mandatory for use in all solicitation proposals for IGES data files and implementations (i.e., computer-aided design and manufacturing systems) acquired twelve (12) months after the effective date.

11.2 Acquisition of IGES Implementations and Data Files. Conformance to this standard should be considered whether the CAD/CAM systems are developed internally, acquired as part of a system procurement, acquired by separate procurement, used under a

leasing agreement, or specified for use in contracts for programming services. Recommended terminology for procurement of FIPS IGES is contained in the U.S. General Services Administration publication *Federal ADP and Telecommunications Standards Index*, Chapter 5, Part 1.

11.3 Interpretation FIPS IGES. Resolutions of questions regarding this standard will be provided by NIST. Procedures for interpretations are specified in FIPS PUB 29-3. All questions concerning the specifications and content should be addressed to:

Director
Computer Systems Laboratory
ATTN: FIPS IGES Interpretation
National Institute of Standards and Technology
Gaithersburg, MD 20899

11.4 Validation of IGES Implementations. Implementations of FIPS for IGES shall be validated in accordance with the NIST Computer Systems Laboratory (CSL) validation procedures for FIPS for IGES, *NISTIR 5541, Procedures for the NIST IGES Validation Test Service*. Recommended procurement terminology for validation of FIPS for IGES is contained in the U.S. General Services Administration publication *Federal ADP and Telecommunications Standards Index*, Chapter 5, Part 2. This GSA publication provides terminology for three validation options: Delayed Validation, Prior Validation Testing, and Prior Validation. The agency shall select the appropriate validation option and shall specify appropriate time frames for validation and correction of nonconformities. The agency is advised to refer to the NIST publication *Validated Products List* for information about the validation status of IGES products. This information may be used to specify validation time frames that are not unduly restrictive of competition.

Implementations shall be evaluated using the NIST IGES Test Suite. The NIST IGES Test Suite was first released in October 1994 to assist users and vendors determine compliance with FIPS PUB 177 and/or MIL-D-28000, Class II subset. The results of validation testing by the NIST IGES Validation Test Service are published on a quarterly basis in the *Validated Products List*, available from the National Technical Information Service (NTIS).

Current information about the NIST IGES Validation Test Service and validation procedures for FIPS for IGES is available from:

National Institute of Standards and Technology
Computer Systems Laboratory
Graphics Software Group, IGES Test Service
Building 225, Room A266
Gaithersburg, MD 20899

12. Waivers.

Under certain exceptional circumstances, the heads of Federal departments and agencies may approve waivers to Federal Information Processing Standards (FIPS). The head of such agency may redelegate such authority only to a senior official designated pursuant to section 3506(b) of Title 44, U.S. Code. Waivers shall be granted only when:

a. Compliance with a standard would adversely affect the accomplishment of the mission of an operator of a Federal computer system, or

b. Cause a major adverse financial impact on the operator which is not offset by Governmentwide savings.

Agency heads may act upon a written waiver request containing the information detailed above. Agency heads may also act without a written waiver request when they determine that conditions for meeting the standard cannot be met. Agency heads may approve waivers only by a written decision which explains the basis on which the agency head made the required finding(s). A copy of each such decision, with procurement sensitive or classified portions clearly identified, shall be sent to: National Institute of Standards and Technology; ATTN: FIPS Waiver Decisions, Technology Building, Room B-154; Gaithersburg, MD 20899.

In addition, notice of each waiver granted and each delegation of authority to approve waivers shall be sent promptly to the Committee on Government Operations of the House of Representatives and the Committee on Governmental Affairs of the Senate and shall be published promptly in the *Federal Register*.

When the determination on a waiver applies to the procurement of equipment and/or services, a notice of the waiver determination must be published in the *Commerce Business Daily* as a part of the notice of solicitation for offers of an acquisition or, if the waiver determination is made after that notice is published, by amendment to such notice.

A copy of the waiver, any supporting documents, the document approving the waiver and any supporting and accompanying documents, with such deletions as the agency is authorized and decides to make under 5 U.S.C. Sec. 552(b), shall be part of the procurement documentation and retained by the agency.

